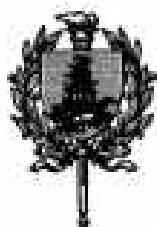


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Contribution from the Bureau of Entomology, L. O. Howard, Chief.

THE TRUE ARMY WORM¹ AND ITS CONTROL.

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INTRODUCTION.

This publication is designed to convey to the farmer, in a brief and simple manner, the natural history of the true army worm, a caterpil-

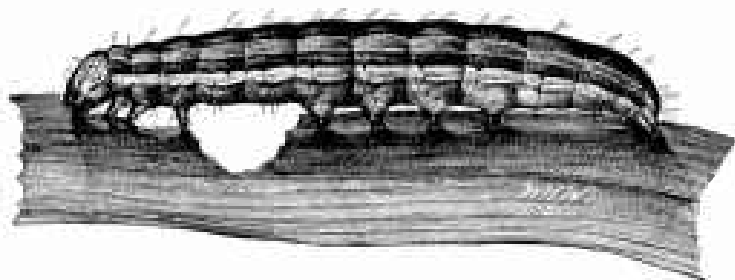


FIG. 1.—The true army worm: Full-grown larva or caterpillar. Enlarged. (Original.)

lar which from time to time becomes enormously destructive to growing cereals, and sometimes to forage crops; to give him a summary of the information necessary for its control; and especially to urge upon him the necessity for constant vigilance in the combat with this insect.

The true army worm (fig. 1) is often confused in the public mind with the fall army worm,² "overflow worm," or "grass worm" as

¹ (*Heliothela*) *Cirphis unipuncta* Haw.; order Lepidoptera, family Noctuidae.

² *Laphygma frugiperda* S. & A.

NOTE.—This bulletin is of general interest to crop growers everywhere, and especially east of the Rocky Mountains.

it is known in some of the extreme Southern States. The latter insect always originates in the South and travels northward as the summer advances. The western army cutworm¹ also is occasionally mistaken for the true army worm, but it occurs in destructive abundance only throughout the regions west of the Mississippi River. Both of the latter insects will be treated in a separate publication.

GENERAL DESCRIPTION.

The fully developed parent of the army worm (figs. 2, *a*, and 5) is a moth or "miller" measuring about $1\frac{1}{2}$ inches across the expanded wings. It is brownish-gray in color, having a single small white spot near the center of the front pair of wings, the hind wings being somewhat darker along the hind edges. Although these parents of the worm sometimes are very numerous, they fly only at night and are therefore often entirely overlooked by the farmer. The stage of the insect most familiar to him is the full-grown, striped, nearly naked caterpillar (figs. 1 and 2, *b*), usually discovered in the act of devouring his crops and in most cases after having already destroyed the greater portion of the infested crop.

WHERE THE ARMY WORM OCCURS.

The true army worm is probably a native of North America, although it is also found in South America. It occurs throughout most of the United States east of the Rocky Mountains, including the States bordering the western banks of the Mississippi and the Missouri Rivers. It also has been found in New Mexico, Arizona, and California. It is not known from the Rocky Mountain Plateau region. (See fig. 3.)

ECONOMIC IMPORTANCE AND MANNER OF INJURY.

The loss in money to the farmer by army worms in the past has been exceedingly great, and although no exact estimate is possible, it is safe to say that in the Eastern States alone many millions of dollars' worth of grain and forage crops have disappeared down their throats during the past 30 years.

¹ (*Chorizagrotis*) *Euxoa auxiliaris* Grote.

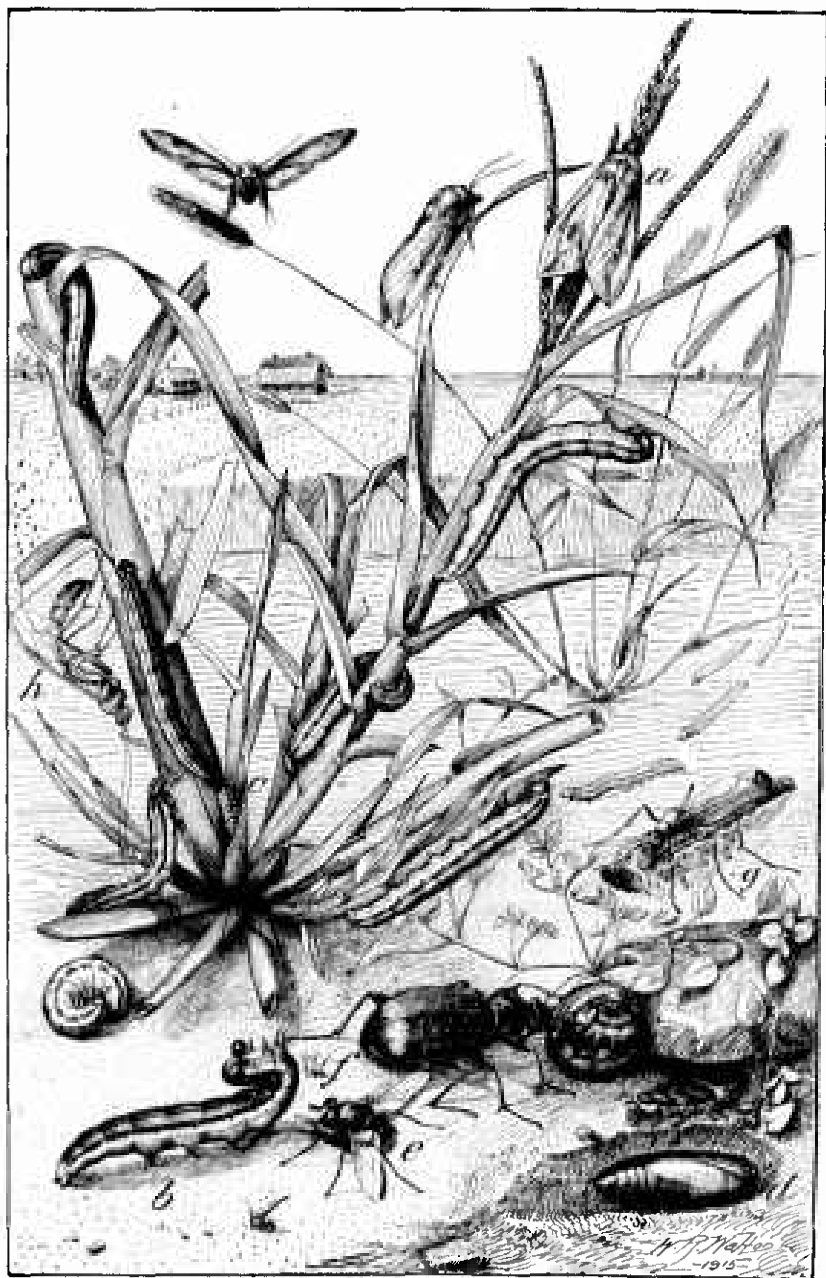


FIG. 2.—Stages and work of the true army worm and some of its insect enemies: *a*, Parent or moth; *b*, full-grown larva; *c*, eggs; *d*, pupa in soil; *e*, parasitic fly, *Winthemia quadripustulata*, laying its eggs on an army worm; *f*, a ground beetle, *Calosoma calidum*, preying upon an army worm, and, at right, *Calosoma* larva emerging from burrow; *g*, a digger wasp, *Sphex* sp., carrying an army worm to its burrow; *h*, *Enticospilus purgatus*, a wasplike parasite of the army worm. All about natural size. (Original.)

The army worm injures crops in but one way, and that is by eating away all the tender portions of the leaves, the immature seed, and sprouts, and when numerous it may even devour the plants down to the very ground. The more important and by far the most conspicuous injury is always inflicted by the nearly full-grown caterpillar, whose greed and capacity for food are almost unbelievable. The pupa takes no food. The moth subsists principally upon the nectar gathered from flowers.

FOOD PLANTS.

The army worm feeds by preference upon grasses, both wild and cultivated; next, upon the grasslike grains, such as the several varie-

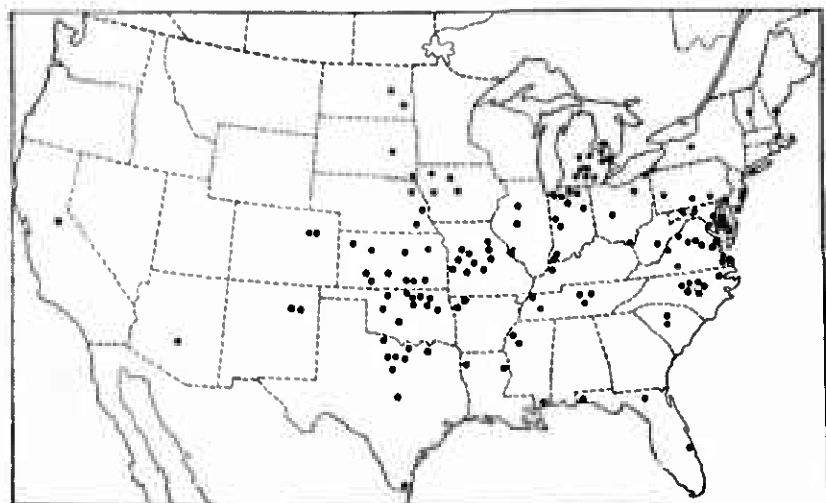


FIG. 3.—Map showing localities in the United States in which the true army worm has been destructive. (Original.)

ties of millet, which suffer severely during outbreaks of the insect. Wheat in its unripe stages, corn, oats, and rye seem to be preferred in the order named. In some portions of the country alfalfa also suffers injury; apparently damage to this crop occurs only in the Southwestern States—Texas, Oklahoma, New Mexico, and Arizona. Occasionally clover is attacked, but such occurrences are rare.

WHERE INVASIONS OF THE ARMY WORM COME FROM.

The true army worm usually appears in the fields very suddenly, and it seems quite certain that the moths at times fly in great numbers for many miles, in the direction of the prevailing winds, and alight in a body to deposit their eggs at some place favorable to the development of their offspring. This fact accounts for the sudden

appearance of the army worm in regions far removed from any known source of infestation. The moth, however, seems to be present in small numbers, over most of the area in which it occurs, during a portion of every year, but this fact does not account for the sudden great invasions which occur from time to time.

WHEN INVASIONS MAY BE EXPECTED.

Generally speaking, outbreaks of the true army worm are more common following cold, backward springs and should be looked for first in neglected portions of fields upon which rank growths of wild grasses or lodged and fallen unripe grain are to be found. These should be examined frequently and closely, especially during late April, May, June, and early July, in order to discover the small greenish caterpillars, which may be found in great numbers feeding near the surface of the ground under the sheltering, overhanging leaf blades.

LIFE HISTORY.

The army worm, like many other common insect pests, has four forms or stages, as follows: First, the parent moths or millers, which seek out rankly growing grass or grasslike grains, such as millet, upon which they lay their eggs (fig. 2, *c*). From these eggs hatch the little caterpillars or "worms," which feed and grow rapidly. When full grown they shed their skins and change to the brown pupa or resting stage, usually beneath the surface of the soil. From these pupæ come the parent moths, which in turn mate and lay their eggs, thus providing for another brood of caterpillars. There are usually three generations of caterpillars in any one year, but seldom or never two successive outbreaks in any given locality.

THE EGG STAGE.

The eggs are laid by the parent moths at night, usually in the folded blades or under the leaf sheaths of grains and grasses (fig. 2, *c*). These resemble small white beads, each considerably smaller than the head of a common pin, and are deposited in masses or rows on the plants selected. Moist or shaded spots usually are chosen for this purpose by the moths, many of which seem to congregate and lay their eggs in the same locality. These eggs hatch in from 8 to 10 days and from them come the very small greenish caterpillars or "worms."

THE CATERPILLAR OR LARVAL STAGE.

When the caterpillars are first hatched they are very tiny and, although countless thousands of them may be present, they consume,

at this time, comparatively little food. Feeding near the ground, sheltered from view by the overhanging grain or grasses, they almost invariably escape the notice of the farmer. If the colony of worms can be discovered at this stage of their growth the infestation usually can be stamped out completely by prompt and vigorous measures, such as spraying with arsenicals or covering with straw and burning over the infested spot.

As the young worms grow and feed, their skins become too small for them, so presently they split and are shed, and the caterpillars begin feeding more greedily than ever. This occurs several times during the life of the caterpillar, until the worm becomes full grown. The time required for full growth is from 3 to 4 weeks. The full-grown army worm (figs. 1 and 2, *b*) is a nearly naked, smooth, striped caterpillar, about $1\frac{1}{2}$ inches long. Its general color is usually greenish, and the stripes, one along each side and a broad one down the center of the back, are dark and often nearly black. The stripe along the back usually has a fine, light-colored, broken stripe running down its center. The color of the body between the dark stripes varies from greenish to reddish brown. The head is greenish brown speckled with black.

When an army of these worms is at work in a field the champing of their jaws is plainly to be heard, as they greedily devour every blade in sight. In this stage the army worm frequently consumes all of the food supply near the place where it has developed from the egg. When such is the case the caterpillars mass together and crawl away in a body in search of other food. It is this habit which has gained for the insect the popular name of "army worm." The massing together of the worms affords the farmer an opportunity of destroying them in great quantities by mechanical methods described on a following page of this publication. When the full-grown caterpillars cease feeding they usually burrow into the soil to the depth of a few inches and by dint of twisting and turning form a cavity or cell therein. The worm then begins to shrink and shorten, after which the skin splits and is shed and the pupa appears beneath it. When the worms are very numerous many of them pupate on the surface of the ground, hidden under clods, boards, or bunches of dried grass and fallen grain.

THE PUPA OR RESTING STAGE.

The pupa (figs. 2, *d*, and 4) or resting stage of the true army worm resembles a date seed in size and shape, but is more pointed at one end. In color it is at first a reddish or chestnut brown, becoming almost black as the time for emergence of the moth approaches. Its

skin or covering is smooth and tough, and the pupa is unable to move any portion of its body excepting its tail, which it wriggles vigorously upon being disturbed. If the soil in which the pupæ are resting be lightly cultivated during this time and the pupæ thrown to the surface, most of them will be killed by exposure to the weather, crushed by the cultivating implements, or eaten during the day by birds or at night by skunks which roam the fields and consume great quantities of such food.

THE PARENT OR MOTH STAGE.

When the moth (figs. 2, *a* and 5) crawls forth from the pupal case it has not yet developed its wings, which are crumpled and folded in pad-like masses on each side of its back. It usually crawls up the stem of some plant and begins to expand its wings, waving them back and forth slowly for about an hour, by which time they are completely developed and the insect is capable of flying. However, if undisturbed, the moths will usually remain at rest for several hours before flying away to mate and lay their eggs. It takes from 7 to 8 weeks for the insect to develop from the egg to the adult or moth.

After the moths have expanded their wings they do not grow any larger; the small moths are not the young of larger moths, but the



FIG. 4.—The true army worm: Pupa. Enlarged. (Original.)

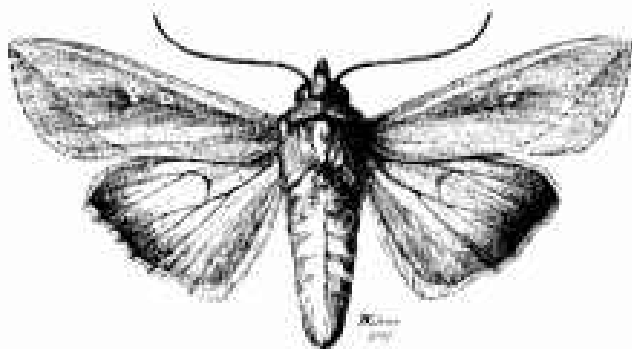


FIG. 5.—The true army worm: Parent or moth. Enlarged. (Original.)

male moth or parent of the army worm is usually considerably smaller than the female.

The army worm moth is strongly attracted to lights at night and frequently swarms of these moths are seen about lights out of doors shortly before an outbreak of the army worm. Farmers would

therefore do well to learn to recognize the moth at sight, as in this way they could be warned of the probable subsequent injurious abundance of the caterpillar. The moths may readily be known by their plain brownish-gray appearance and the presence of a single very small, almost pure white speck or spot near the center of each of the front wings (see figs. 2, *a* and 5). The moths seldom or never lay their eggs near the spot where they have developed and frequently fly for many miles before doing so. Thus there are seldom two successive outbreaks during the year in any given locality. It is not yet definitely known where or how the army worm lives over

the winter, but the indications are that it does so in the partially grown caterpillar stage.

HISTORY OF THE ARMY WORM IN THE UNITED STATES.

The army worm has been known as a serious pest on cereal and forage crops in the United States since early colonial times. As early as the year 1632 it is recorded as injuring corn in New England by Peter Kalin, a Swedish naturalist who traveled in this country. In the year 1743 a great outbreak of the army worm is recorded as having occurred

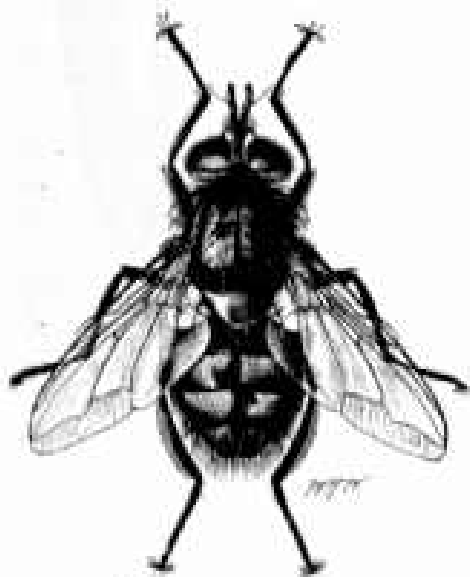


FIG. 4.—*Winthemia quadripustulata*, a fly parasitic on the true army worm: Adult. Much enlarged. (Original.)

throughout that portion of the country now known as the North Atlantic States. From then down to the present time the insect has hampered agriculture and robbed the farmer mercilessly at comparatively short but irregular intervals of time. The most recent serious invasion occurred during the summer of 1914, at which time the entire agricultural region east of the Rocky Mountains and north of the Gulf States suffered to a greater or less degree. From the past history of the insect the farmer may confidently expect to be compelled to cope with it from time to time, and he should ever be on the alert during the spring and early summer months in order to discover the pest before it has made serious inroads upon his crops.

NATURAL ENEMIES.

Most fortunately for the farmer, the army worm has many natural enemies among the native insects, reptiles, birds, and mammals.

INSECT ENEMIES.

One of the commonest and most effective of its insect foes is a medium-sized gray fly¹ (fig. 6), closely resembling, and slightly larger than, the house fly. This parasite sticks its eggs fast to the skin of the caterpillar (fig. 2, *b* and *e*) and the quickly hatching maggots bore through the skin into the flesh, where they soon devour the entire inside portions of the army worm's body. These flies multiply rapidly and often become so numerous as to control the army worm completely in a given locality.

Another common insect foe is a very small wasplike creature (fig. 7),² which pierces the caterpillar with its sting or ovipositor, laying its eggs inside the army worm's body, where they quickly hatch and, the maggots having eaten their fill, bore their way outward and spin little silken cocoons in a mass together, somewhat resembling grains of rice entangled in a mass of cotton. This parasite is also sometimes numerous enough to be of great service in controlling the pest.

Several other insect enemies serve more or less efficiently in combating the army worm. Some of these are shown in figure 2, *f*, *g*, *h*.³

WILD BIRDS AND OTHER ENEMIES.

According to the records of the United States Biological Survey, more than 40 species of native wild birds are known to eat the army worm in its various stages. Among the most important of these are the following: Crow blackbird or grackle, yellow-headed blackbird, chipping sparrow, bluebird, prairie hen, and European starling. Domestic fowls of all kinds will greedily devour the caterpillars and pupæ if allowed to roam over infested fields. Skunks and toads also undoubtedly eat thousands of the army worms, both caterpillars and



FIG. 7.—Larva of the army worm surrounded by silken cocoons of the wasplike parasite *Apanteles militaris*. About natural size. (Original.)

¹ *Wirthemia quadripustulata* Fab.

² *Apanteles militaris* Say.

³ *Calosoma calidum* Fab., (*Ammophila*) *Sphex* sp., and *Enticospilus purgatus* Say.

pupæ. These birds and other animals should therefore be encouraged and protected by the farmer by all possible means.

CONTROL MEASURES.

WATCHFULNESS AS A FACTOR.

The importance of watchfulness, on the part of the farmer, as a factor in combating the army worm can not be too greatly emphasized. Upon the discovery of the pest in its younger stages depends very largely the possibility of stamping out an infestation before serious injury to crops has occurred. The farmer should examine his meadows frequently during the spring and early summer months, particularly those planted to timothy, bluegrass, and especially millet. He should not be satisfied with looking merely at the surface of the stand; the thicker and longer the growth, the greater the danger from the army worm. The grass or grain should be parted with the hands in various parts of the field and the lower portions of the growth closely examined, in order to discover the presence of the small, greenish caterpillars, and if such be found in any number the area covered by the infestation should be determined and vigorous action taken at once to destroy the worms before they become large enough to begin their journey to other portions of the farm. If the infested spot be small, the grass or grain can be mowed off and straw scattered over the spot and burned, thus destroying the worms. If the caterpillars have become distributed over a considerable area, this can be marked off by stakes and the crop sprayed heavily with a mixture of Paris green at the rate of 1 pound to 50 gallons of water. In case this poison is used, care should be exercised in preventing stock from gaining access to the poisoned grass or grain and being injured or killed by eating it. It is far better to sacrifice a portion of the crop, if the destruction of the pest can be accomplished thereby, because if the army worms are not destroyed they will take the crop anyway and probably devastate other portions of the farm.

POISONED BAITS.

Poisoned baits of varying composition have long been used as a means of destroying the many different species of cutworms and also the army worm. An efficient bait of this kind may be prepared and used as follows: To 50 pounds of wheat bran and 1 pound of Paris green or 2 pounds of arsenate of lead add the juice of one-half dozen oranges or lemons. Then bring the mass to a stiff dough by adding low-grade molasses or sirup, preferably the former, and scatter the mixture broadcast in small pieces throughout the infested field. This poisoned bait may be safely used in alfalfa

and cornfields where it is desired, if possible, to save the crop for forage purposes.

MECHANICAL MEASURES.

In case the worms are not discovered until they have begun to travel in a mass, they can usually be destroyed by furrowing or ditching (fig. 8) completely around the infested area. In attempting to cross such ditches the worms will fall into them and can easily be destroyed by crushing them with a log dragged back and forth through the ditch or furrow. If shallow post holes are sunk in the bottom of the ditch at intervals of about 20 feet, the worms will crawl along the ditch bottoms and fall into the holes, where



FIG. 8.—Ditch prepared to entrap marching army worms. A log, dragged back and forth through the ditch, crushes the worms which have fallen into it. (Original.)

they may be destroyed by crushing or other means. If the subsoil be of such a nature that water penetrates it but slowly, the post holes may be partially filled with water, on the top of which a layer of coal oil or petroleum may be poured. Upon falling into such holes, the worms are almost immediately destroyed without further action on the part of the farmer.

SUMMARY OF CONTROL MEASURES.

(1) Watch fields of growing grass and grain carefully, especially the meadows, during the spring and early summer months, in order

to discover the army worms before they have a chance to become full grown and spread over the entire farm. When the worms are discovered at work do not lose a minute, but attack them vigorously by means of the measures outlined in the foregoing pages.

(2) In case the worms are crawling in a body, surround them with a furrow or ditch and crush them with a log drag as they fall into it.

(3) Poison them by spraying crops not intended for forage purposes with 1 pound of Paris green to 50 gallons of water, or with 2 pounds of arsenate of lead to 50 gallons of water. In case the Paris green is used on tender plants, like corn, 2 pounds of freshly slaked lime should be added to 50 gallons of the mixture. This is to prevent burning the tender plants. Where spraying is not practicable, the use of the poisoned bran bait, mentioned on page 10 of this publication, is strongly recommended.